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## PATENT SPECIFICATION



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### PROVISIONAL SPECIFICATION

#### Improvements relating to the Manufacture of Constructional Work and the Production of Templates or like Marking-off Devices

We, REDPATH, BROWN & COMPANY, LIMITED, of 2, St. Andrew Square, Edinburgh, 2, Scotland, a British Corporation, and WILLIAM CRAWFORD, of the said Company's address, British Subject, do hereby declare the nature of this invention to be as follows:—

This invention has reference to an improved method of manufacturing constructional work or templates or like devices for marking-off or setting-out the work for structural or general engineering purposes or for any other purpose where it is customary to mark-out the work from 10 a reduced-scale drawing.

It may be explained that, in engineering establishments, it is customary to first prepare a detailed drawing of the work either to a reduced scale or fully dimensioned, and this drawing is delivered to the template or pattern workshop where a working drawing is made from the reduced-scale or dimensioned drawing, the working drawing being sometimes 20 marked out on the floor or on the platform of the workshop or being marked out on a sheet or board, so that a template or pattern can be produced, which is then used for marking-off or setting-out the 25 final work.

It is an object of the present invention to simplify and reduce the labour involved incidental or preparatory to marking-off or setting-out the final work, and although 30 we have specifically mentioned engineering establishments in the foregoing paragraph, it will be understood that there are various kinds of workshops in which similar methods are employed in setting-out or marking-off the work, and our invention facilitates the preparatory operations for the marking-off or setting-out of work in any establishment in which methods similar to that above described 35 have previously been employed.

It is also explained that, in structural engineering works, it is usual to mark-out girders and beams or other large structural elements of metal, wood or other 40 material from a full-size drawing made on the floor or platform of the workshop or from a full-size template or pattern,

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and the present invention is of particular utility in the marking-out of such structural elements in a simplified and less 55 laborious manner.

Although the invention, as will herein-after be described, primarily contemplates the production of a full-size representation on the work itself, so that 60 the work can be directly marked-off or set-out, the invention may also be utilized for the rapid and accurate production of templates, patterns or like marking-off devices either full-size or to any other 65 desired scale for use in setting-out or marking-off the final work.

According to the present invention the manner of manufacturing constructional work from an original reduced-scale 70 detailed drawing comprises the steps of first optically projecting a full-size representation of the original (or a part thereof or a transparency made therefrom) directly upon the work itself, thereupon marking-off or setting-out the details of the representation on the surface of the work in a more or less permanently visible manner, and thereafter subjecting the work to the ordinary machining processes 75 according to the details marked-off or set-out on the surface of the work.

Alternatively, the constructional work is manufactured in known manner with the aid of a template, pattern or like marking-off device made from an original reduced-scale detailed drawing and produced according to the invention by first optically projecting a full-size representation of the original drawing (or a part thereof or a transparency made therefrom) directly upon a template sheet of paper, cardboard, wood, metal or other material, thereupon marking-off or setting-out the details of the representation on the surface of the template sheet in a substantially permanently visible manner, and thereafter cutting, shaping, boring, punching or otherwise machining the template sheet according to the details 80 marked-off or set-out on the surface thereof.

The optical representation may be projected on to a template sheet laid upon

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workshop or being marked out on a sheet or board, so that a template or pattern can be produced, which is then used for marking-off or setting-out the final work.

5 It is an object of the present invention to simplify and reduce the labour involved incidental or preparatory to marking-off or setting-out the final work, and although we have specifically mentioned engineering establishments in the foregoing paragraph, it will be understood that there are various kinds of workshops in which similar methods are employed in setting-out or marking-off the work, and our 10 invention facilitates the preparatory operations for the marking-off or setting-out of work in any establishment in which methods similar to that above described have previously been employed.

15 20 It is also explained that, in structural engineering works, it is usual to mark out girders and beams or other large structural elements of metal, wood or other material from a full-size drawing made 25 on the floor or platform of the workshop or from a full-size template or pattern, and the present invention is of particular utility in the marking-out of such structural elements in a simplified and less 30 laborious manner.

Although the invention, as will hereinafter be described, primarily contemplates the production of a full-size representation on the work itself, so that the work 35 can be directly marked-off or set-out, the invention may also be utilized for the rapid and accurate production of templates, patterns or like marking-off devices either full-size or to any other desired 40 scale for use in setting-out or marking-off the final work.

It has previously been proposed to draw the outlines of aircraft in full scale on a floor, the outlines being copied off, also 45 to full size, on to aluminium sheets which are then photographed on to sensitized glass plates, employing a huge camera so large that two rooms have to be used to accommodate it. After the glass plates have 50 been developed in gigantic tanks and fixed, each negative so produced is replaced in the camera which is now used with a projection lamp as a projector for projecting an image to any required size 55 on to a sensitized metal plate. Thus copies can be made and distributed to as many departments as are concerned in making any given part.

As will be hereinafter manifest, our 60 process is distinguished therefrom in that it does not start with the making of a full scale drawing on the workshop floor, this labour being eliminated.

A method has also been proposed to 65 provide working guides for the making

of tools, fixtures and parts in which engineering drawings are photographed full size or to any desired size on to sensitized glass plates, which after being developed and fixed are replaced in the camera and the original full size drawing replaced by a sheet of sensitized material such as paper, fabric, wood or metal, thus making possible the transfer of drawings to metal or other sheets for cutting, drilling and pressing. The shape of parts can thus be reproduced on the material of which the parts are to be subsequently constructed by cutting, machining or other processes.

In making templates cut from composite sheet material it has been proposed to apply sensitized printing paper to one side of a metal foil and a paper backing to the reverse side, the printing paper being such as that used in the production of working drawings, for example, blue prints, on which a photographic print can be directly made from a drawing on tracing cloth or other material from which a photographic print such as a blue print can be made. There was no suggestion, however, of producing by optical projection an image of a reduced scale drawing on the sensitized side of the composite sheet.

In making dies, punches and like tools for the mass-manufacture of stamped-out articles, it has also been proposed to first make a lay-out or development drawing of the article to natural size, e.g. on tracing paper, then to print it on the sensitized side of a piece of metal by any suitable method of printing, e.g. by a direct contact printing process, whereupon the metal is processed or machined and formed or bent to produce a sample article of the desired final shape. After the sample is found to be correct, the same tracing is used and printed on a block or blocks of material from which the punches, dies, or 100 like tools are made in substantially the same manner as the sample article. Alternatively, the print on the block of metal may be a natural size print made from a photographically enlarged or reduced copy 105 of an original reduced or enlarged scale drawing. A series of tools can be made from a single layout on tracing paper, this layout being reproduced by photographic methods to produce reproductions 110 which are then printed on the sensitized side of the blocks of metal from which the series of tools is to be made.

The manner of manufacturing constructional parts, or templates, pattern sheets 115 or like devices for marking-off or setting-out constructional work according to the present invention comprises projecting an enlarged optical image of a reduced-scale original detailed drawing of the construc- 120 125 130

not desired to reproduce in the representation, or to enable the projection apparatus to be used with original pictures of different sizes.

5 The representation may be produced in a plane parallel to the original picture or in a plane at right angles thereto or inclined to the plane of the original picture in the projection apparatus according 10 to the type of projection apparatus employed and depending upon the position of the optical axis of the apparatus relatively to the surface upon which the representation is to be projected.

15 The manner of manufacture according to the invention effects a substantial saving in the time and labour involved in marking-off or setting-out the work as compared with the conventional methods 20 at present employed.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we 25 claim is:—

1. The method of manufacturing constructional parts, or templates, pattern sheets or like devices for marking off or setting-out constructional work, which 30 comprises projecting an enlarged optical image of a reduced-scale original detailed drawing of the constructional parts or constructional work directly upon material from which the said constructional parts 35 or templates or pattern sheets or like devices are to be made, the said image being a full-size representation upon the said material of the said drawing (or of a part thereof), thereupon marking-off, 40 setting-out or copying details of the said image upon the said material in a manner to produce an enduring or lasting representation of the said drawing upon the said material, and thereafter machining 45 the said material (by drilling, cutting, shaping, boring, punching and other known processes) according to the details

of the said enduring or lasting representation.

2. The modification of the method 50 claimed in claim 1 wherein, instead of projecting directly upon the material an image of the reduced-scale drawing, there is projected upon the said material the image of a transparency produced by 55 direct photography from the reduced-scale original detailed drawing.

3. The manufacture of constructional parts, or templates, pattern sheets or like devices by the method claimed in claim 1 60 or 2 wherein the material is laid upon a floor surface and the image is projected downwards upon the said material.

4. The manufacture of constructional parts, or templates, pattern sheets or like devices by the method claimed in any of the preceding claims, using a material having a light-sensitized surface upon which the optical image is directly projected, the said surface being subsequently 70 treated in known manner to develop the image on the said material and to produce the enduring or lasting representation according to the details of which the material is thereafter machined as set 75 forth in claim 1.

5. The modification in the method claimed in any of the preceding claims of the manufacture of templates, pattern sheets or like devices for marking-off or setting-out constructional work 80 wherein, instead of projecting an optical image of the reduced-scale original detailed drawing or part thereof or transparency therefrom to full scale, it is 85 projected to any desired scale directly upon the material from which the templates, pattern sheets or the like are to be made.

Dated this 1st day of August, 1941.

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